Corona Prediction for the August 1, 2008 Total Solar Eclipse

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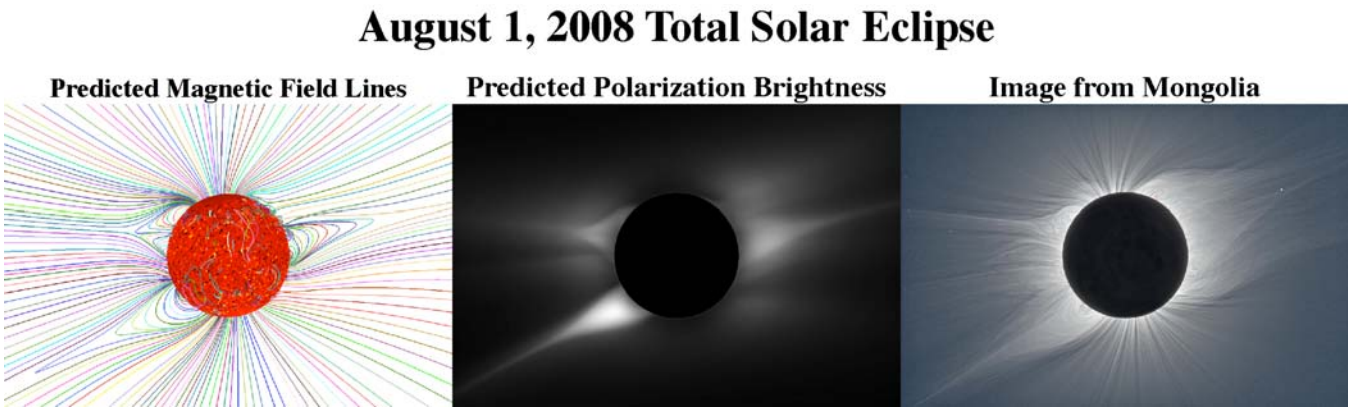
On August 1, 2008, a total solar eclipse was visible in the northern hemisphere within a narrow corridor starting over northern Canada, in the north polar region, and in northern Russia, western Mongolia, and China. On July 17, 2008, an MHD computation was begun of the solar corona, in preparation for a prediction of what the solar corona would look like during this eclipse. Photospheric magnetic field data measured up to July 6, 2008, by the MDI magnetograph aboard the SOHO spacecraft, was used. This prediction was updated on July 27 with a higher resolution calculation and with updated MDI magnetic field data measured through July 21.

The energy transport in the model was improved to include the effects of coronal heating, the conduction of heat parallel to the magnetic field lines, radiative losses, and the effect of Alfvén waves. This produces a significantly better estimate of the plasma temperature and density in the corona and allows a prediction of the emission in extreme ultraviolet (EUV) wavelengths and X-rays, in addition to emission in polarized white light (polarization brightness) that is typically measured during an eclipse.

A comparison of the prediction with a composite image of the eclipse is shown below. The remarkable similarity indicates that the prediction captures the large-scale structure of the plasma and magnetic field in the corona. When predictions match observations it provides reassurance that the models may one day be able to predict space weather events.



Comparison between the predicted eclipse corona from the MHD model and an image taken in Bor Udzuur, Mongolia (© Miloslav Druckmüller, Peter Aniol, and Vojtech Rušin). The eclipse image is a composite of many photographs with different exposures, with considerable sharpening applied to emphasize filamentary structures.